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Radiographic assessment of hip and knee osteoarthritis. Recommendations: recommended guidelines

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Summary

Pathological lesions of osteoarthritis, demonstrated by conventional radiography, can be assessed by scoring systems and/or measurement with a quite acceptable reproducibility. Scores are recommended for a rough staging of osteoarthritis and of bone changes. Measurement is recommended for assessment of joint space narrowing progression. A good assessment of progression implicates a perfect reproducibility of the radiographic image of the joint. Accuracy of standard radiograph is improved by some views such as the hip profile and the schuss view.

Key words: Osteoarthritis, Radiography, Clinical trials, Guidelines.

Introduction

Conventional radiography shows the main pathological lesions of osteoarthritis (OA): cartilage destruction [evaluated by joint space narrowing (JSN)], osteophytes, bone sclerosis and cysts. Despite of its known lack of sensitivity, radiography is regularly used for the study of both the natural progression of OA and structure modifying drugs. Such studies necessitate an accurate and reliable assessment of OA radiographic lesions. This has lead during the last years to the emergenge of several new methods. The following seven recommended guidelines derive from the review of these reported studies.

1. Carefully select one observer and keep them trained

Radiographic assessment of OA is a difficult task. Clearly, intraobserver agreement is much better than interobserver agreement and some observers do much better than others. The job must therefore be restricted to highly experienced teams and be made by one observer selected as the best one of the team. The influence of formation and training on observer reliability is also clearly demonstrated and training must be made regularly, especially when a large series needs a long period of observation.

2. Use a scoring system for evaluation of OA severity at entry

Patient selection and comparison of groups of patients necessitate a rough and simple classification of OA severity. Joint space width (JSW) can be used in such a goal. However, the use of a continuous variable, which largely varies between normal individuals, could be difficult to handle. Scoring systems seem therefore more relevant. The Kellgren and Lawrence score is the simplest one. However, it relies on a mixture of OA features and it prejudjes of a unique sequence of events (osteophytes preceding JSN) which does not always fit with reality. Thus a separate scoring for each OA lesion[1,2] can be considered as easier to perform and more informative. Scoring must be made with the help of an atlas which improves reliability.[2,3] Scores of six grades has been proposed for JSN.[4–5] However, a four-grade score (none, mild, moderate, severe) is generally used and should be prefered for simplicity.

3. Use a scoring system to evaluate progression of osteophytes and sclerosis

Presently, progression of osteophytes, sclerosis and cysts can only be assessed by scoring systems. Reproducibility of the scores, resulting from repeated evaluations of the same film, can be considered as quite acceptable. However, evaluation of sclerosis and cysts seems less reproducible than evaluation of osteophytes.[1,5–9] Osteophytes and sclerosis have been found to be correlated with radiographic progression of JSN and must be evaluated. Evaluation of bone cysts, which are only occasional and which have no known relationship with OA progression, is probably of marginal interest. Correlation with biological bone markers could be of interest.

4. Measure JSW for the evaluation of JSN progression

Progression of JSN can be assessed by various scores with a good intraobserver reproducibility. With exception of the Kellgren and Lawrence score, scores were sensitive enough for the demonstration of a significant JSN progression in a limited number of patient with hip and knee OA over a 1 year follow-up.[4] However, measurements of JSW,

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which are more explicit, are considered as more reliable and more sensitive to change than scores.[10] JSW, as a minimum interbone distance or a mean width, can be measured manually or with a digital image computer. Measurement of the minimum interbone distance can be made with a caliper, a one-tenth millimeter graduated magnifying lens,[11] a simple half a millimeter graduated plastic ruler[7] or with a computer.[12] Mean JSW is obtained from the measurement of a constant surface area.[5,13,14]

The ruler has bee found more accurate than caliper and magnifying glass.[7] Nevertheless, digital image analysis seems more accurate than manual measurement. Using a computerized image analysis, a 3.2% and 1.2% intra-observer coefficient of variation (CV) was obtained in measuring JSW of the tibiofemoral joint and the hip joint, respectively.[10,14] Accuracy of the method can be partly explained by digitization of the film which allows a sharp delineation of the bone edges. Computer also allows the control of possible change in magnification, which may be of importance.[10]

Measurement of minimum JSW could be more sensitive to change than a surface area which may include areas of normal joint space. However, measurement of a surface area is probably more reliable, probably less sensitive to change in both radiographic procedures and patient positioning and remains possible when the interbone distance is nil.[14] Measurement of a mean JSW in a selected area of interest is probably more appropriate than measurement in unselected areas. Thus, measurement of both minimum JSW and mean JSW with a digital image analysis can be recommended.

5. Standardize positioning of the patient and radiographical procedures

An accurate evaluation of the progression of OA lesions also implicates a high quality and a high reproducibility of the radiographic image of the joint. Reproducible images of the femorotibial joint are quite difficult to obtain. A good view of the joint space, with an horizontal tibial plateau, necessitates fluoroscopy. Changes in both patient positioning and radiographic procedures were shown to highly affect JSW.[10] Reliability of the routine X-ray of the pelvis is less known. However the CV for the mean JSW increased from 1.2 to 3.3% when estimated, respectively, from the same 20 films and from the films of 20 patients radiographed by three different technicians.[14] The latter were from the same hospital and a larger CV can be expected from films made in different conditions.

6. Use routine X-ray of the pelvis for hip OA, but explore the hip profile

The standard anteroposterior radiograph of the pelvis must be recommended since it has been used in several studies, offering known changes in the rate of JSN per year. However, other views could improve the accuracy of hip JSN evaluation. In patients with hip OA, a significant decrease in JSW with weigth-bearing was only found when using hip centered radiographs.[15] Relatively to routine pelvis X-ray, a higher score of JSN was found on the hip profile of Lequesne in nearly 30% of patients with hip OA (Conrozier *et al.* unpublished data). Reproducibility of the hip profile is probably difficult but the view could improve the accuracy of JSN evaluation and of its progression in a number of patients.

7. Use routine X-ray of the knee and an additional view in a constant degree of knee flexion

The standard anteroposterior radiograph of the femorotibial joint must be recommended for the same reasons than for the hip. However its use alone is quite questionable. JSW has been shown to vary significantly in patients with femorotibial OA radiographed when standing on one foot.[5] This means that JSW varies with load , a point clearly difficult to monitor in long term studies. Similarly, JSW has been shown to largely vary in the same patients radiographed in a nearly 30° knee flexion (schuss view). JSW decreased by nearly 20% in medial knee OA and 67% in lateral knee OA when comparing the schuss view with routine radiographs.[5] Sensitivity to change was also suggested to be largely increased by the schuss view. Thus an additional view in a constant degree of knee flexion is recommended.

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